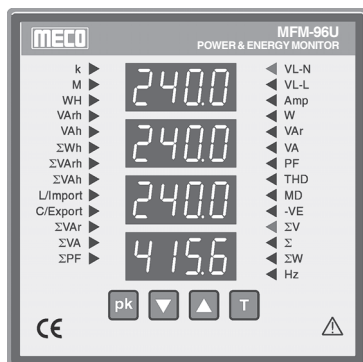




**MULTIFUNCTION POWER &
ENERGY MONITOR WITH MODBUS RTU PROTOCOL
MODEL : MFM-96UMT/UE**



Installation and User Manual

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Introduction

MFM-96UMT/UE universal Multifunction Meter is a microcontroller based electrical analyzer indicating TRMS values of Various electrical parameters. It measures 68 parameters & displays on 22 display pages each page has matrix 4 rows of LED display of 4 digit each. It features user programmable function such as Password Protection, CT Ratio, PT Ratio, Meter configuration setting, Instrument address, MD Period, Auto scroll & Energy Erase facility. It is equipped with a 4 key keypad for scrolling through display pages & to set the programmable function.

For MFM96UE MD & THD features not available

Safety Recommendations

To guarantee the level of safety incorporated in the device, follow the instructions below :

- 1) Adhere strictly to the connection diagrams for the installation of the instrument.
- 2) Before gaining access to the terminal, ensure that the conductors to be connected to the instrument are not live.
- 3) Make sure that the electrical panel in which the instrument is to be placed is designed in such a way as to guarantee that the terminals are inaccessible after installation.

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Technical Specifications

Display	: 4 Rows of 4 digit RED LED display For Energy Measurement 8 Digit 00000000 ~ 99999999 x 10 ⁵ LED Display Height 9.2mm / 0.36"
Key Pads	: 4 function keys to scroll through display pages and to set programming parameters.
Measuring Interval	: 0.5 sec
Operating Temp.,	: 0°C to 50°C
Humidity	: <90% RH (Non Condensing)
Dimension (mm)	: Front 96 x 96 mm Depth (Behind Bezel) 60 mm Panel Cutout 92 x 92 mm
Weight	: 490 gms. (approx)

Electrical Specifications

System	: 3 Phase 3 Element 4 Wire } Factory Set 3 Phase 2 Element 3 Wire }
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Auxiliary Power Supply :

Nominal (Range)	: 230V AC (185~264V AC) 110V AC (90~126V AC) optional
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Frequency	: 50Hz
Burden	: < 5 VA

Voltage Input : for 3P 4W

Nominal	: 230V / 240V AC (Phase - Neutral) □
Measurement	: 400V / 440V AC (Phase - Phase)
Max. Range	: 300V AC Max. (Phase - Neutral) 4 520V AC (Phase - Phase)

Voltage Input	: for 3P 3W
Nominal Measurement	: 110V AC / 440V AC (Phase - Phase)
Max. Range	: 150V ~ 530V AC (Phase - Phase)
Burden	: < 0.3 VA / Phase
Accuracy Range	: 20% ~ 120%
PT Ratio	: Use PT for higher input ranges. PT Ratio Fully Programmable (1.000 ~ 9999)

Current Input	:
Nominal	: 5A AC (Line) isolated
Measurement	: 1A AC (against specific order)
Range	: 1 ~ 6A AC Max
Burden	: < 0.1VA / Phase
Max. Current	: 200% for 1 sec. (10A max.)
Accuracy Range	: 20 ~ 120%
CT Ratio	: Use CT for higher input ranges. CT Ratio Fully Programmable (1.000 ~ 9999)

Programmable Parameters	: CTR, PTR, Configuration setting, Password, peak demand period (minute), Auto Scroll, Instrument address (000~247)
--------------------------------	---

Accuracy :	
Voltage	: ± 0.2% of Full Scale
Current	: ± 0.2% of Full Scale
Active Power	: ± 0.5% (CosF = 0.3 to 1.00) of Full Scale
Reactive Power	: ± 1% (SinF = 0.3 to 1.000) of Full Scale
Apparent Power	: ± 0.5% of Full Scale
Power Factor	: ± 1° Electrical
Energy	: Class 1
Frequency	: ± 0.2Hz (45 ~ 65Hz)

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Processing method - for 3 Phase 3 Element 4 Wire

a) Phase Values :

$$\text{Effective phase voltage } V_n (\text{TRMS}) = \sqrt{\frac{\sum_{i=1}^N [V_n(i)]^2}{N}}$$

$$\text{Effective phase current } I_n (\text{TRMS}) = \sqrt{\frac{\sum_{i=1}^N [I_n(i)]^2}{N}}$$

$$\text{Active phase power } P_n = \frac{\sum_{i=1}^N V_n(i) I_n(i)}{N}$$

$$\text{Apparent phase power } S_n = V_n(\text{TRMS}) \times I_n(\text{TRMS})$$

$$\text{Reactive phase power } Q_n = \sqrt{S_n^2 - P_n^2}$$

$$\text{Phase power Factor } PF_n = \frac{P_n}{S_n}$$

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b) Equivalent system Values :

Equivalent system voltage	$V_T = \frac{V_1 + V_2 + V_3}{\sqrt{3}}$
Equivalent system current	$I_T = \frac{I_1 + I_2 + I_3}{\sqrt{3}}$
System active power	$P_T = P_1 + P_2 + P_3$
System reactive power	$Q_T = Q_1 + Q_2 + Q_3$
System apparent power	$S_T = S_1 + S_2 + S_3$
Equivalent system power factor	$PF_T = \frac{P_T}{S_T}$

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Processing method - for 3 Phase 2 Element 3 Wire

a) Phase Values :

Effective phase voltage

$$V_n (TRMS) = \sqrt{\frac{\sum_{i=1}^N [V_n(i)]^2}{N}}$$

Effective phase current

$$I_n (TRMS) = \sqrt{\frac{\sum_{i=1}^N [I_n(i)]^2}{N}}$$

Active power - first phase

$$P_1 = V_{RY} \times I_R \times \cos(30 + F)$$

Active power - third phase

$$P_3 = V_{YB} \times I_B \times \cos(30 - F)$$

Reactive power - first phase

$$Q_1 = V_{RY} \times I_R \times \sin(F + 30)$$

Reactive power - third phase

$$Q_3 = V_{YB} \times I_B \times \sin(F - 30)$$

PF phase 1

$$PF_1 = \cos(30 + F)$$

PF phase 3

$$PF_3 = \cos(30 - F)$$

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b) Equivalent System Values :

Equivalent system voltage	$V_T = \frac{V_1 + V_2 + V_3}{\sqrt{3}}$
Equivalent system current	$I_T = \frac{I_1 + I_2 + I_3}{\sqrt{3}}$
System active power	$P_T = P_1 + P_3$
System reactive power	$Q_T = Q_1 + Q_3$
System apparent power	$S_T = S_1 + S_3$
Equivalent system power factor	$PF_T = \frac{P_T}{S_T}$

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Key Pad

The key Pad contains 4 keys with the following functions in normal operation.

pk	Optional for Max. Demand page
▼	Down “▼” is used to move to next page.
▲	Up “▲” is used to move previous page.
T	“T” is used to move to first (system) page.

Operating Modes

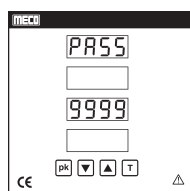
Parameter setting mode (Programming mode) :

This mode can be invoked by pressing “▲” & “▼” keys simultaneously at power on. In this mode eight pages are available for settings, namely Password Protection, CT ratio, PT ratio, Meter configuration setting, Instrument address, MD period, Auto Scroll Mode & Energy Erase mode of Instrument.

A) Password Protection :

The first screen appears after entering in Parameter Setting Mode is Enter Password. It ask the user to enter password to change the parameter settings.

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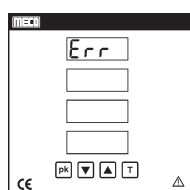


The user should first enter 9999 (MECO Password)

The user should enter correct password by using “▲” & “▼” keys.

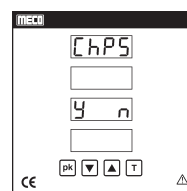
The “▼” key is used to enter the digits (0 to 9) & “▲” key is used to shift the digit position (Right to Left).

After entering the password, press “pk” key to confirm it.

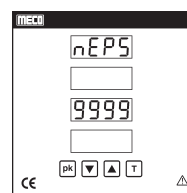


If the entered password is wrong an error message appears on screen.

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If password is correct “pk” key is pressed again then change password screen appears.



If the user wants to change password then should press “pk” key to select y (yes). If he don't want to change password than he should press “T” key.

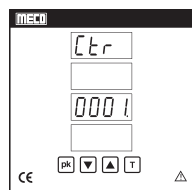
If y is selected then new password screen appears.

The user may select new password by using “▲” & “▼” key overwrite on existing password. After overwriting new password he should press “pk” key to confirm it.

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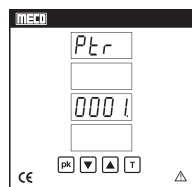
On pressing “pk” key password is stored & CT ratio setting page is displayed.

If user select n (no) for password change then meter directly scrolls to CTR screen.



B) CT ratio setting page : CT ratio is set by using “▲”, “▼” & “T” keys. The digit to be incremented is selected by pressing “▲” key. The selected digit can be incremented using “▼” key.

Decimal point position is shifted by pressing “T” key. Shifting of decimal point from first to fourth digit, On pressing “pk” key, CT ratio is stored and PT ratio setting page is displayed.

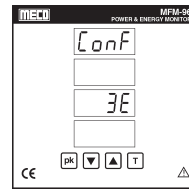


C) PT ratio setting page :

PT ratio is set by using “▲”, “▼” & “T” keys. The digit to be incremented is selected by pressing “▲” key. The selected digit can be incremented by pressing “▼” key. Decimal point position is shifted by pressing “T” key. Shifting of decimal point from first

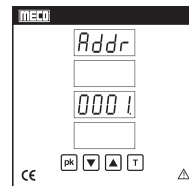
to fourth digit.

On pressing “pk” key, PT ratio is stored and configuration setting page is displayed.



D) Configuration setting page :

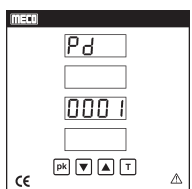
For setting configuration 3E/2E press “▼” key. On pressing “pk” key, the configuration setting is stored & Instrument address setting page is displayed.



E) Network address setting page :

Instrument address is set using “▲” & “▼” keys. The digit that is to be incremented is selected by pressing “▲” key. The selected digit can be incremented by pressing “▼” key. On pressing “pk” key, instrument address is stored & Peak Demand Period page is displayed.

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F) Peak demand period page :

Peak demand period is set by using “▲”, “▼” keys. The digit to be incremented is selected by “▲” key. The selected digit is incremented by “▼” key on pressing “pk” key peak demand period is stored and Auto mode is displayed.

G) Auto mode :

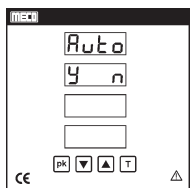
The user may choose Factory selected Auto interval for Auto scrolling of the parameter pages.

If the user wants to enter the Auto scroll mode then he should press “pk” key. When the input is applied the meter runs in Autoscroll mode. If the user wants to use Manual scroll, then he should press “T” key to deselect Autoscroll mode & then “pk” key to confirm.

When “pk” or “T” key is pressed instrument switches to Energy erase mode.

H) Energy Erase mode :

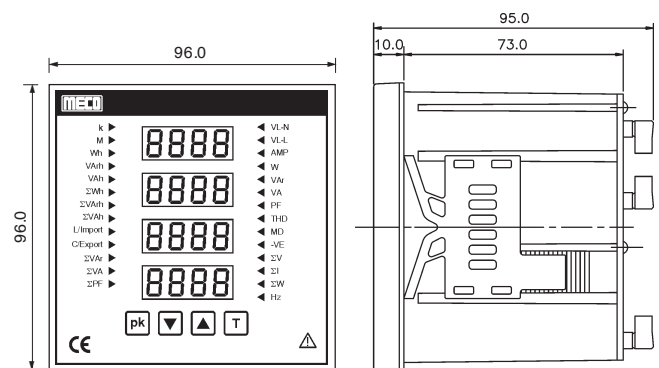
The user may erase the stored energy in the meter. If user wants to erase the energy he should press “pk” key. If user does not want to erase the energy he should press “T” key. When “pk” key is pressed instrument switches to quantity display mode (normal mode).



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Mechanical Dimensions (mm)

Model : MFM-96UMT/UE



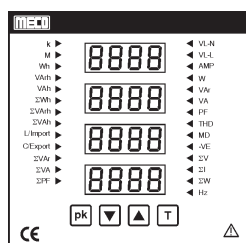
Front View

Side View

Panel Cutout = 92 x 92mm (Max.)

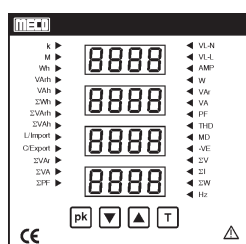
16

Display Indication



1) Numerical Field Zone

This consists of four rows of four digits each. The first row indicates measurement for phase 1, second row indicates measurement for phase 2 (0000 for 3P2E3W), third row indicates measurement for phase 3 & fourth row indicates measurement for the whole system except system page.



2) Customised Symbol Zone

This zone backs up the numerical indications and is used to give a “clear” indication of the type of measurement being taken.

► VL-N = Line to Neutral Voltage in VAC

► VL-L = Line to Line voltage in VAC

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- ◀ Amp = Phase current in ampere
 - ◀ W = Active Power in Watt
 - ◀ Var = Reactive Power in Var
 - ◀ VA = Apparent Power in Volt Ampere
 - ◀ PF = Power factor of phase angle between Voltage & Current for respective phase
 - ◀ MD = Indicates Maximum Demand of Active / Apparent Power
 - ◀ THD = Indicates Total Harmonics Distortion of Voltage / Current
 - ◀ -VE = Indication of system export power of the system
 - ◀ SV = Indicates system Voltage on fourth row of display (see note-1)
 - ◀ SI = Indicates system Current on fourth row of display (see note-1)
 - ◀ SW = Indicates system Active power on fourth row of display (see note-1)
- Note-1** = Except system page on which first row = SV, Second row = SI & Third row = SW
- ◀ Hz = Frequency of voltage line

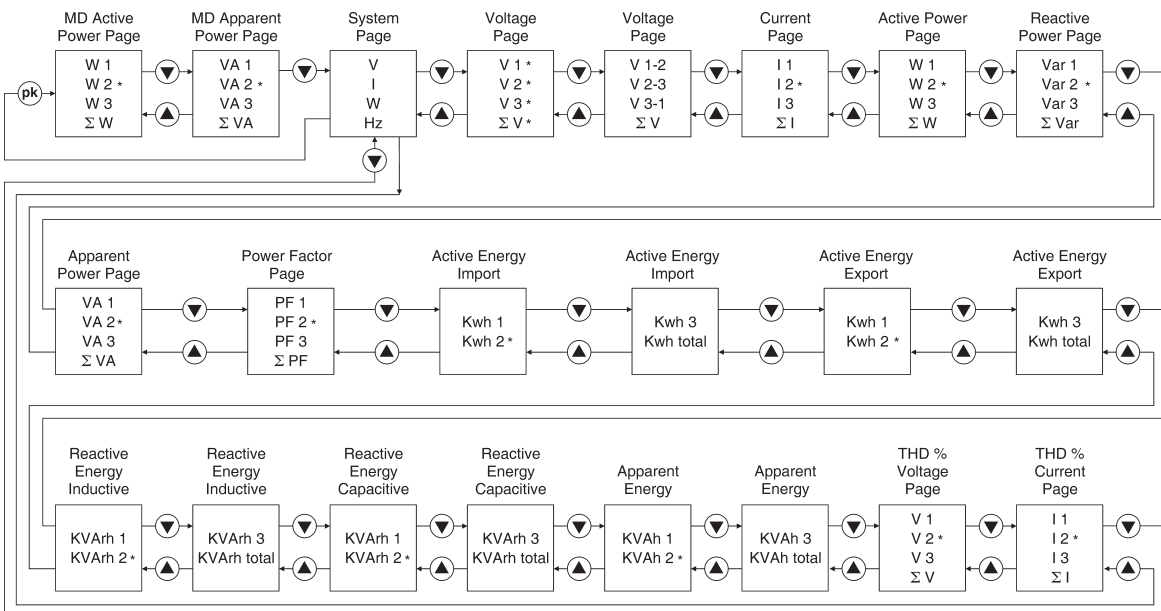
- K ► = Indication of Kilo
- M ► = Indication of Mega
- Wh ► = Active energy (Phase)
- VArh ► = Reactive energy (Phase)
- VAh ► = Apparent energy (Phase)
- SWh ► = System active energy
- SVArh ► = System reactive energy
- SVAh ► = System apparent energy
- L/Import ► = Indication of energy as import for active energy & inductive for reactive energy
- C/Export ► = Indication of energy as export for active energy & capacitive for reactive energy
- SVAr ► = System reactive power
- SVA ► = System apparent power
- SPF ► = System power factor

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Page Sequence Diagram

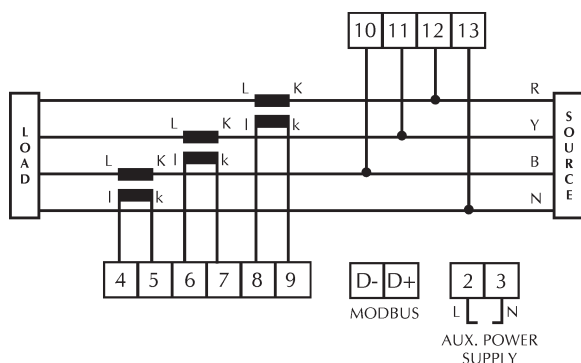
* Applicable only for MFM-96UMT/UE (3P3E)

Note : T
When you are operating any other page by pressing this key system page will appear



Connection Diagrams

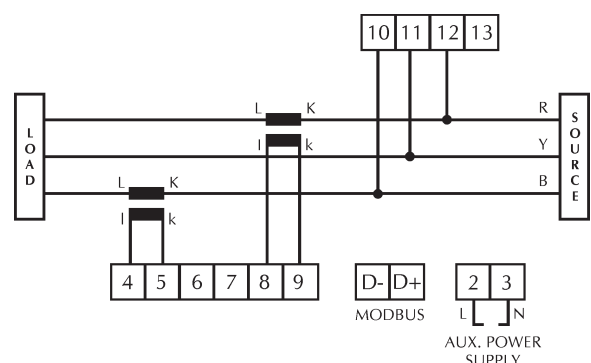
3 Phase 3 Element 4 Wire



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Connection Diagrams

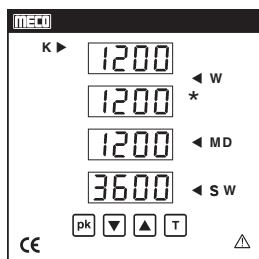
3 Phase 2 Element 3 Wire



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Sequences of Display Pages

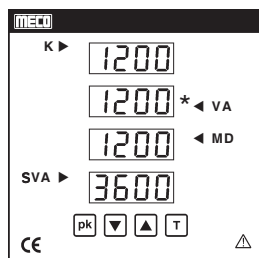
System 3P3E4W / 3P2E3W 240V, 5A & Phase angle 0°



1) Maximum Demand Phase Active Power page :

This page appears on the display after power is switched on & if pk key is pressed.

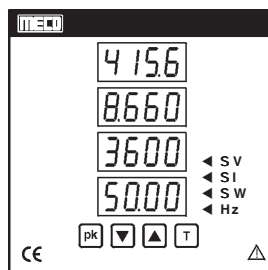
This page displays the Maximum Demand of phase active power value for each of the three phases & system active power.



2) Maximum Demand Phase Apparent Power page :

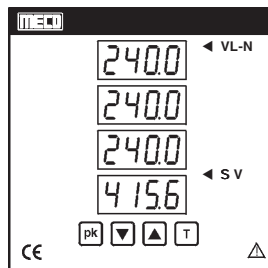
This page appears on the display after Maximum Demand Phase Active Power page if "▼" key is pressed.

This page displays the Maximum Demand of Phase apparent power value for each of the three phases & system apparent power.



3) System page :

This page appears on the display after the power is switched on & "T" Key is pressed or after Maximum Demand Phase Apparent Power page if "▼" key is pressed. This page shows system parameters, i.e. system voltage, system current, system active power & system frequency.

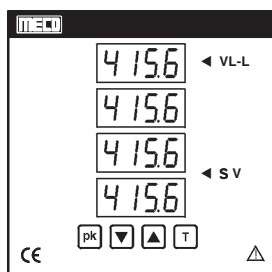


* 4) Effective Phase Voltage page :

This page displays the phase to neutral voltage (TRMS) for all the three phases & system voltage.

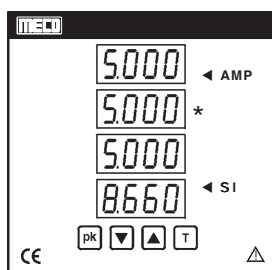
* Applicable only for MFM-96UMT/UE (3P3E)

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5) Effective Line Voltage page :

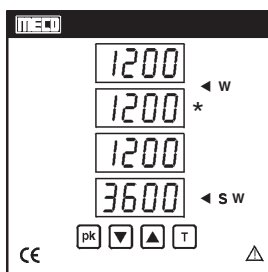
This page displays the line to line voltages (TRMS) for each of the three phases & system voltage.



6) Effective Phase Current page :

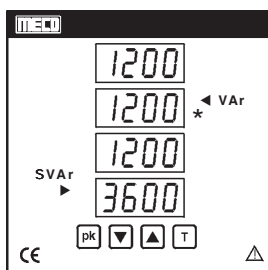
This page displays the Phase Current (TRMS) value for each of the three pages & system current.

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7) Phase Active Power page :

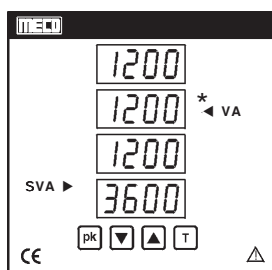
This page displays the phase active power value for each of the three phases & system active power.



8) Phase Reactive Power page :

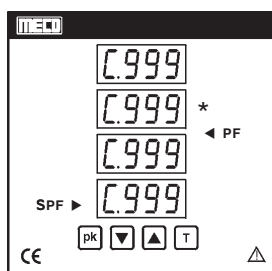
This page displays the phase reactive power values for each of the three phases & system reactive power.

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9) Phase Apparent Power page :

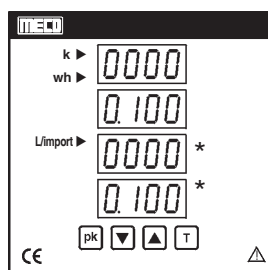
This page displays the phase apparent power value for each of the three phases & system apparent power.



10) Phase Power Factor page :

This page displays the phase power factor value for each of the three phases & system power factor.

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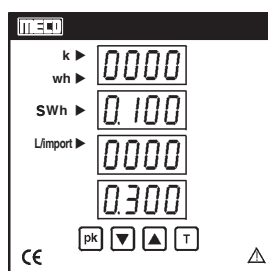


11) Active Energy page :

(Energy import - Kwh1, Kwh2 at phase angle 0°)

This page displays active energy value of 1st & 2nd phase.

To read Energy take 8 digit value
eg. Kwh1 = 00000.100 Kwh &
Kwh2 = 00000.100 Kwh
should be read



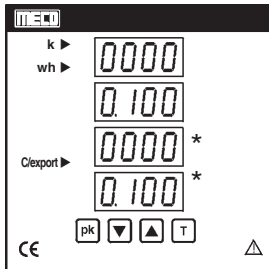
12) Active Energy page :

(Energy import - Kwh3, Kwh total at phase angle 0°)

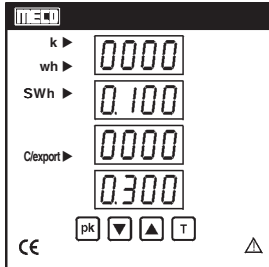
This page displays active energy value of 3rd Phase & total active energy import.

eg. Kwh3 = 00000.100 Kwh &
KwhSys = 00000.300 Kwh

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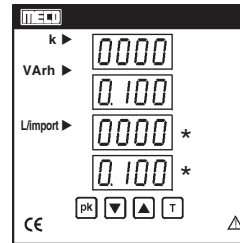


13) Active Energy page :
(Energy export -Kwh1, Kwh2 - phase angle 180°)
This page displays active energy value export for 1st & 2nd phase.
eg. Kwh1 = 00000.100 Kwh &
Kwh2 = 00000.100 Kwh

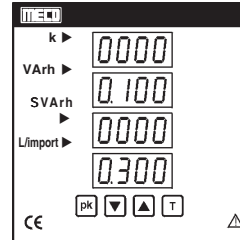


14) Active Energy page :
(Energy export - Kwh3, Kwh total - phase angle 180°)
This page displays active energy value of 3rd Phase & total active energy export.
eg. Kwh3 = 00000.100 Kwh &
KwhSys = 00000.300 Kwh

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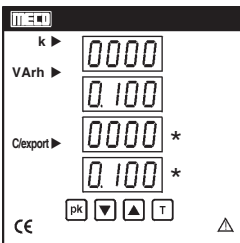


15) Reactive Energy page :
(Energy inductive - KVArh1, KVArh2 - phase angle 90°)
This page displays reactive energy inductive of 1st & 2nd phase.
eg. KVArh1 = 00000.100 KVArh &
KVArh2 = 00000.100 KVArh

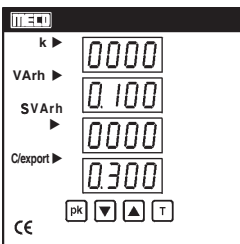


16) Reactive Energy page :
(Energy inductive - KVArh3, KVArh total - phase angle 90°)
This page displays reactive energy inductive of 3rd Phase & total reactive energy inductive.
eg. KVArh3 = 00000.100 KVArh &
KVArhSys = 00000.100 KVArh

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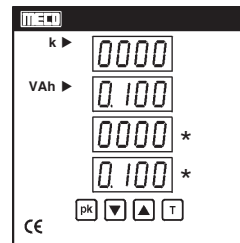


17) Reactive Energy page :
(Energy capacitive - KVArh1, KVArh2 - phase angle 270°)
This page displays reactive energy capacitive of 1st & 2nd phase.
eg. KVArh1 = 00000.100 KVArh &
KVArh2 = 00000.100 KVArh

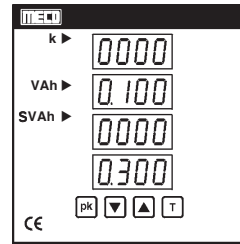


18) Reactive Energy page :
(Energy capacitive - KVArh3, KVArh total - phase angle 270°)
This page displays reactive energy capacitive of 3rd Phase & total reactive energy capacitive.
eg. KVArh3 = 00000.100 KVArh &
KVArhSys = 00000.100 KVArh

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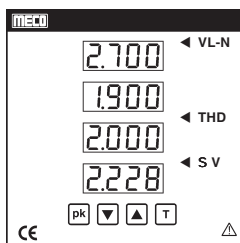
19) Apparent Energy page :
(KVAh1, KVAh2)
This page displays apparent energy for phase 1 & phase 2.
eg. KVAh1 = 00000.100 KVAh &
KVAh2 = 00000.100 KVAh



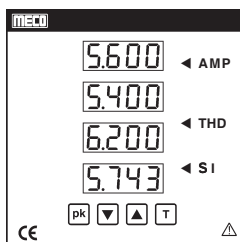
20) Apparent Energy page :
(KVAh3, KVAh total)
This page displays apparent energy for 3rd Phase & total apparent energy.
eg. KVAh3 = 00000.100 KVAh &
KVAhSys = 00000.100 KVAh

*** Applicable for 3P3E in 3P2E mode this reading is always zero.**

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21) Total Harmonics Distortion (%) Phase Voltage page :
This page displays the Total Harmonics Distortion (%) values of phase to neutral voltage (TRMS) for all the three phases & system voltage.



22) Total Harmonics Distortion (%) Phase Current page :
This page displays the Total Harmonics Distortion (%) values of phase Current (TRMS) value for the three pages & system current.

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Serial Output

The instrument has a RS-485 serial output & can be connected through RS485 to RS232 converter to a personal computer. MFM-96UMT/UE is identified by its own address, which can be configured from the instrument keyboard (See parameter setting mode page).

The software communication protocol is dedicated to a network of Meter and has following characteristics :

- Twisted screened duplex cable for connection up to 1200m.
- RS - 485 line, two wire multidrop.
- Speed : 9600 baud rate.
- Data bits - 8, Parity - N, Stop bits - 1

Power Master Software MODBUS-RTU (Version 02 .04)

When the power master software is installed it is possible to monitor all the quantities measured, alongwith their graphical view. In this way it is possible to obtain data files and time trend of the quantity measured.

Minimum Hardware Requirements :

- Pentium II (350MHz)
- 32 MB Ram
- 10 MB Hard Disk (Free space)
- 1 COM serial port dedicated to RS-232 / 485 connection.

Software : Windows 95, 98, 98SE, 2000, ME, XP

Printers (If Used) : Printers compatible with Windows 95

Distribution : CD ROM

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RS 485 / RS 232 Interface Connection

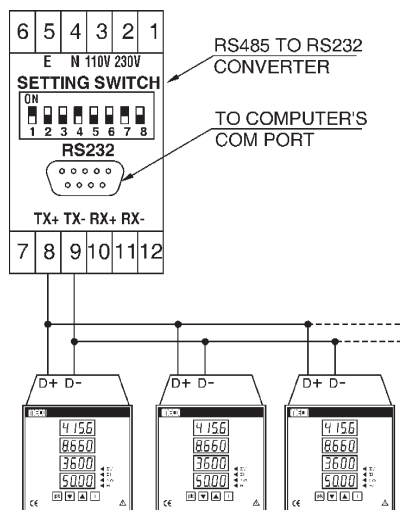


fig. 'A'

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RS 485 / RS232 Interface

Connect the Instrument to the PC through RS485 to RS232 Converter.

Power the RS485/RS232 interface module by means of its own power supply (230V/50Hz). Follow the connection diagram as shown in fig. 'A'.

Check that the setting of dip-switch on the interface is effectively positioned as shown in the connection diagram.

Installation and Start-Up

To install the Power Master Software, proceed as follows.

- 1) Place CD in the drive. It will automatically run the setup.
- 2) A window to confirm the installation of Power Master 2.04 will be displayed. click " Next " to continue installation and " Exit " to abort installation.
- 3) Next window displays information about the licence agreement. Click " Next ".

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- 4) Now next window will ask for the directory in which the Power Master, MODBUS-RTU Ver. 2.04 Software is to be installed. Give the appropriate path & click " Next "
- 5) Now click " Start " to start the installation.
- 6) When installation is successfully completed a window will confirm the success of the installation operation press " Next ".
- 7) Now click " Exit ".

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NOTE

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NOTE



CERTIFICATE OF CALIBRATION

We hereby certify that this product has been calibrated and found to be in accordance with the applicable SPECIFICATIONS and MECO STANDARDS.

Accuracies of the standard equipment used in this calibration are traceable to the National Standards.

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Fax : 0091-22-27673310, 3330

E-mail : sales@mecoinst.com

SR. NO : _____
CHECKED BY : _____
DATE : _____
MODEL NO : _____